CLAIMS

What is claimed is:

1. In a computer controlled graphics display system wherein objects are represented by data structures defining: the orientation and location of a plurality of polygons; and texture data defining surface characteristics of said object, said data structures at least partially stored in computer memory prior to rendering on a display screen, a method for subdividing polygons having a high degree of perspective, said method comprising the steps of:

(a) selecting, from said computer memory, a selected polygon from said plurality of polygons that at least partially define a depiction of said object, said selected polygon comprising at least three vertices wherein each vertex has a perspective term, W, associated therewith that defines a display perspective of said associated vertex with respect to a given viewing angle;

(b) determining perspective ratios for each pair of adjacent vertices of said at least three vertices of said selected polygon;

(c) subdividing said selected polygon to generate a plurality of new polygons provided any of said perspective ratios exceeds a preselected perspective threshold amount; and

(d) rendering and displaying said selected polygon on a display screen of said computer controlled graphics display system provided none of said perspective ratios exceeds said preselected perspective threshold amount.

2. A method as described in Claim 1 further comprising the step of: (e) repeating said steps of (a)-(c) for each new polygon generated by said step (c).

3. A method as described in Claim 1 wherein said step (c) comprises the steps of:

(c1) dividing said selected polygon into four new polygons provided three edges of said selected polygon have perspective ratios exceeding said preselected threshold amount;

(c2) dividing said selected polygon into three new polygons provided only two edges of said selected polygon have perspective ratios exceeding said preselected threshold amount; and

(c3) dividing said selected polygon into two new polygons provided only one edge of said selected polygon has a perspective ratio exceeding said preselected threshold amount.

4. A method as described in Claim 3 wherein said step (c1) comprises the step of inserting three mid-points between adjacent vertex pairs of said selected polygon to constitute new vertices for said four new polygons, wherein said step (c2) comprises the step of inserting two mid-points between adjacent vertex pairs of said selected polygon to constitute new vertices for said three new polygons, and wherein said step (c3) comprises the step of inserting one mid-point between an adjacent vertex pair of said selected polygon to constitute a new vertex for said two new polygons.

5. A method as described in Claim 4 further comprising the step of determining data for each inserted midpoint resultant from said steps (c1), (c2), and (c3), said data comprising: three dimensional coordinate values (x,

y, z); texture map coordinate values (u, v); color (R, G, B); and perspective terms (W).

6. A method as described in Claim 5 wherein said step of determining data for each inserted midpoint comprises the steps of:

(1) calculating a perspective term, Wmid, for a midpoint of a given adjacent pair of vertices, A and B, in accordance with:

$$Wmid = (WA + WB) / 2$$

where WA and WB denote perspective terms for said vertices A and B, respectively;

(2) calculating intermediate variables, a and a', in accordance with:

$$a = uA * WA$$

$$a' = vA * WA$$

where uA and vA respectively denote the u-axis and v-axis texture coordinates for said vertex A;

(3) calculating intermediate variables, b and b', in accordance with:

$$b = uB * WB$$

$$b' = vB * WB$$

where uB and vB respectively denote the u-axis and v-axis texture coordinates for said vertex B;

(4) calculating intermediate variables, c and c', in accordance with:

$$c = (a + b) / 2$$

$$c' = (a' + b') / 2; \text{ and}$$

(5) calculating umid and vmid in accordance with:

$$umid = c / Wmid$$

$$vmid = c' / Wmid$$

where umid and vmid are the texture coordinates for said midpoint.

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7. A method as described in Claim 1 wherein for a given pair of adjacent vertices, A and B, said step (b) comprises the steps of:

(b1) dividing a perspective term associated with vertex A with a perspective term associated with adjacent vertex B to obtain a first perspective ratio associated with said given pair of adjacent vertices; and

(b2) dividing said perspective term associated with vertex B with said perspective term associated with adjacent vertex A to obtain a second perspective ratio associated with said given pair of adjacent vertices.

8. A method as described in Claim 1 wherein said preselected threshold is between the range of 1.25 to 1.5.

9. A method as described in Claim 1 further comprising the step of receiving said preselected threshold amount from a user defined adjustment.

10. In a computer controlled graphics display system having a processor coupled to bus, and a graphics subsystem coupled to said bus, and wherein objects are represented by a plurality of polygons and texture data defining surface characteristics of object, a computer readable memory unit coupled to said bus and storing instructions therein that when executed causing said system to implement a method for subdividing polygons having a high degree of perspective, said method comprising the steps of:

(a) selecting, from said computer memory, a selected polygon from said plurality of polygons that at least partially define a depiction of said object, said selected polygon comprising at least three vertices wherein each vertex has a perspective term, W, associated therewith that defines a display perspective of said associated vertex with respect to a given viewing angle;

(b) determining perspective ratios for each pair of adjacent vertices of said at least three vertices of said selected polygon;

(c) subdividing said selected polygon to generate a plurality of new polygons provided any of said perspective ratios exceeds a preselected perspective threshold amount; and

(d) rendering and displaying said selected polygon on a display screen of said computer controlled graphics display system provided none of said perspective ratios exceeds said preselected perspective threshold amount

(e) repeating said steps (a)-(d) for each polygon of said plurality of polygons.

11. A computer readable memory unit as described in Claim 10 wherein said method further comprises the step of: (f) repeating said steps of (a)-(c) for each new polygon generated by said step (c).

12. A computer readable memory unit as described in Claim 10 wherein said step (c) comprises the steps of:

(c1) dividing said selected polygon into four new polygons provided three edges of said selected polygon have perspective ratios exceeding said preselected threshold amount;

(c2) dividing said selected polygon into three new polygons provided only two edges of said selected polygon have perspective ratios exceeding said preselected threshold amount; and

(c3) dividing said selected polygon into two new polygons provided only one edge of said selected polygon has a perspective ratio exceeding said preselected threshold amount.

13. A computer readable memory unit of Claim 12 wherein said step (c1) comprises the step of inserting three mid-points between adjacent vertex pairs of said selected polygon to constitute new vertices for said four new polygons, wherein said step (c2) comprises the step of inserting two mid-points between adjacent vertex pairs of said selected polygon to constitute new vertices for said three new polygons, and wherein said step (c3) comprises the step of inserting one mid-point between one adjacent vertex pair of said selected polygon to constitute a new vertex for said two new polygons.

14. A computer readable memory unit as described in Claim 13 wherein said method further comprises the step of determining data for each inserted midpoint as a result of said steps (c1), (c2), and (c3), said data comprising: three dimensional coordinate values (x, y, z); texture map coordinate values (u, v); color (R, G, B); and perspective terms (W).

15. A computer readable memory unit as described in Claim 14 wherein said step of determining data for each inserted midpoint comprises the steps of:

(1) calculating a perspective term, Wmid, for a midpoint of a given adjacent pair of vertices, A and B, in accordance with:

$$Wmid = (WA + WB) / 2$$

where WA and WB denote perspective terms for said vertices A and B, respectively;

(2) calculating intermediate variables, a and a', in accordance with:

$$a = uA * WA$$

$$a' = vA * WA$$

where uA and vA respectively denote the u-axis and v-axis texture coordinates for said vertex A;

(3) calculating intermediate variables, b and b', in accordance with:

$$b = uB * WB$$

$$b' = vB * WB$$

where uB and vB respectively denote the u-axis and v-axis texture coordinates for said vertex B;

(4) calculating intermediate variables, c and c', in accordance with:

$$c = (a + b) / 2$$

$$c' = (a' + b') / 2; \text{ and}$$

(5) calculating umid and vmid in accordance with:

$$umid = c / Wmid$$

$$vmid = c' / Wmid$$

where umid and vmid are the texture coordinates for said midpoint.

16. A computer readable memory unit as described in Claim 10 wherein for a given pair of adjacent vertices, A and B, said step (b) comprises the steps of:

(b1) dividing a perspective term associated with vertex A with a perspective term associated with adjacent vertex B to obtain a first perspective ratio associated with said given pair of adjacent vertices; and

(b2) dividing said perspective term associated with vertex B with said perspective term associated with adjacent vertex A to obtain a second perspective ratio associated with said given pair of adjacent vertices.

17. In a computer controlled graphics display system wherein objects are represented by data structures defining a plurality of polygons and texture data defining surface characteristics of said object, a method for subdividing polygons having a high degree of perspective, said method comprising the steps of:

(a) selecting, from said computer memory, a selected polygon from said plurality of polygons, said selected polygon comprising at least three vertices wherein each vertex has a perspective term, W, associated therewith that defines a display perspective of said associated vertex with respect to a given viewing angle;

(b) determining perspective ratios for each pair of adjacent vertices of said at least vertices of said selected polygon;

(c) subdividing said selected polygon to generate a plurality of new polygons provided any of said perspective ratios exceeds a preselected perspective threshold amount, wherein said step (c) comprises the steps of:

(c1) dividing said selected polygon into four new polygons provided three edges of said selected polygon have perspective ratios exceeding said preselected threshold amount;

(c2) dividing said selected polygon into three new polygons provided only two edges of said selected polygon have perspective ratios exceeding said preselected threshold amount; and

(c3) dividing said selected polygon into two new polygons provided only one edge of said selected polygon has a perspective ratio exceeding said preselected threshold amount; and

(d) rendering and displaying said selected polygon on a display screen of said computer controlled graphics display system provided none of said perspective ratios exceeds said preselected perspective threshold amount.

18. A method as described in Claim 17 further comprising the steps of:

(e) repeating said steps (a)-(d) for each polygon of said plurality of polygons; and

(f) repeating said steps of (a)-(c) for each new polygon generated by said step (c).

19. A method as described in Claim 17 wherein said step (c1) comprises the step of inserting three mid-points between adjacent vertex pairs of said selected polygon to constitute new vertices for said four new polygons, wherein said step (c2) comprises the step of inserting two mid-points between adjacent vertex pairs of said selected polygon to constitute new vertices for said three new polygons, and wherein said step (c3) comprises the step of inserting one mid-point between one adjacent vertex pair of said selected polygon to constitute a new vertex for said two new polygons.

20. A method as described in Claim 17 wherein for a given pair of adjacent vertices, A and B, said step (b) comprises the steps of:

(b1) dividing a perspective term associated with vertex A with a perspective term associated with adjacent vertex B to obtain a first perspective ratio associated with said given pair of adjacent vertices; and

(b2) dividing said perspective term associated with vertex B with said perspective term associated with adjacent vertex A to obtain a second perspective ratio associated with said given pair of adjacent vertices.